



COURSES 1, 2, 3, 4

# Core-Plus Mathematics

Contemporary Mathematics in Context

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| STANDARDS   |                         | PAGE REFERENCES  |
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| <b>Grade Nine</b>   |                         |  |
| <b>Number, Number Sense and Operations Standard</b>   |                         |  |
| <i>Number and Number Systems</i>  |                         |  |
| 1. Identify and justify whether properties (closure, identity, inverse, commutative and associative) hold for a given set and operations; e.g., even integers and multiplication. | <b>Student Edition:</b> | Course 1: 220-221, 226, 229, 336, 490, 495-497, 505  |
| 2. Compare, order, and determine equivalent forms for rational and irrational numbers.  | <b>Student Edition:</b> | Course 1: p. 263 #31, 550 #29, 583 #23   |
| <i>Meaning of Operations</i>  |                         |  |
| 3. Explain the effects of operations such as multiplication or division, and of computing powers and roots on the magnitude of quantities.  | <b>Student Edition:</b> | Opportunity to address throughout:<br>See for examples: 83-89, 94 #10, p143 #30, 33, 38, p285 #24, p299 #1, 316 #29, 319 #36 |
| <i>Computation and Estimation</i>   |                         |  |
| 4. Demonstrate fluency in computations using real numbers.  | <b>Student Edition:</b> | Course 1: 25, 46, 101, 143, 211, 284, 319, 344-347, 396, 490, 549<br>Student Study Guide 1-38                                |

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| 5. Estimate the solutions for problem situations involving square and cube roots.  | <b>Student Edition:</b><br>Course 1: 335-337, 344, 346-347, 397 #38, 455 #35, 509 #29, 520 #10, #11, 521 #20, 523 #27             |
| <b>Measurement Standard</b>  |   |
| <i>Measurement Units</i>   |   |
| 1. Convert rates within the same measurement system; e.g., miles per hour to feet per second; kilometers per hour to meters per second.                    | <b>Student Edition:</b><br>Opportunity to address:<br>Course 1: 111 #6, 124-125, 128, 134, 136-137, 397 #40, 463-488              |
| <i>Use Measurement Techniques and Tools</i>  |   |
| 2. Use unit analysis to check computations involving measurement.  | <b>Student Edition:</b><br>Not addressed  |
| 3. Use the ratio of lengths in similar two-dimensional figures or three-dimensional objects to calculate the ratio of their areas or volumes respectively. | <b>Student Edition:</b><br>Course 1: 12, 62, 63, 68, 285, 452 #22, 490 #35<br>Course 2: 205-210                                   |
| 4. Use scale drawings and right triangle trigonometry to solve problems that include unknown distances and angle measures.                                 | <b>Student Edition:</b><br>Course 2: 457-461, 464, 467-470, 471-473, 474-484, 517-520   |
| 5. Solve problems involving unit conversion for situations involving distances, areas, volumes and rates within the same measurement system.               | <b>Student Edition:</b><br>Course 1: 397, 452 #24<br>Opportunity to address: 68, 285 #25, 472, 474<br>Course 2: Review and 39 #13 |
| <b>Geometry and Spatial Sense Standard</b>   |   |
| <i>Characteristics and Properties</i>  |   |
| 1. Define the basic trigonometric ratios in right triangles: sine, cosine and tangent.   | <b>Student Edition:</b><br>Course 2: 457-466, 467-468   |
| 2. Apply proportions and right triangle trigonometric ratios to solve problems involving missing lengths and angle measures in similar figures.            | <b>Student Edition:</b><br>Course 2: 459, 460, 464, 467-470, 471-473, 474-484, 516-520  |
| <i>Visualization and Geometric Models</i>  |   |
| 3. Analyze two-dimensional figures in a coordinate plane; e.g., use slope and distance formulas to show that a quadrilateral is a parallelogram.           | <b>Student Edition:</b><br>Course 2: 163-169, 170-175, 189 #25, 191 #29, 253 #2   |

## Patterns, Functions and Algebra Standard

### *Use Patterns, Relations and Functions*

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| 1. Define function with ordered pairs in which each domain element is assigned exactly one range element.   | <b>Student Edition:</b><br>Course 2: 326-332, 345 #2&#3, 349 #16, 354 #35  |
| 2. Generalize patterns using functions or relationships (linear, quadratic and exponential), and freely translate among tabular, graphical and symbolic representations.  | <b>Student Edition:</b><br>Course 1: U1, U3, U5, U7<br>Throughout see for examples: 4-8, 22, 28-44, 53, 56-58, 150-236, 463-468, 473-489 |
| 3. Describe problem situations (linear, quadratic and exponential) by using tabular, graphical and symbolic representations.  | <b>Student Edition:</b><br>Course 1: U1, U3, U5, U7<br>Throughout see for examples: 59-68, 70, 150-236, 291-359, 469-474, 480-481        |
| 4. Demonstrate the relationship among zeros of a function, roots of equations, and solutions of equations graphically and in words.   | <b>Student Edition:</b><br>Course 1: 510-529<br>See also Course 2: 332-335, 340-344, 347, 348<br>And Course 3: 112-117, 327-339, 365     |
| 5. Describe and compare characteristics of the following families of functions: linear, quadratic and exponential functions; e.g., general shape, number of roots, domain, range, rate of change, maximum or minimum. | <b>Student Edition:</b><br>Course 1: U3, U5, U7<br>303, 312-314, 316, 323, 325, 331, 345, 483 #12, 487, 488 #24, 524 #30                 |

### *Use Algebraic Representations*

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| 6. Write and use equivalent forms of equations and inequalities in problem situations; e.g., changing a linear equation to the slope-intercept form.   | <b>Student Edition:</b><br>Course 1: 186-191, 264 #35, 284 #21, 423 #35, 454 #29, 489 #26, 508 #26, 585 #32                         |
| 7. Use formulas to solve problems involving exponential growth and decay.  | <b>Student Edition:</b><br>Course 1: 322-331, 356-359<br>Course 2: 377-386  |
| 8. Find linear equations that represent lines that pass through a given set of ordered pairs, and find linear equations that represent lines parallel or perpendicular to a given line through a specific point. | <b>Student Edition:</b><br>Course 1: 160-167, 170-179, 321 #44, 395 #31, 489 #28<br>Course 2: 61-63, 187 #16, 191 #29, 193 #35      |
| 9. Solve and interpret the meaning of 2 by 2 systems of linear equations graphically, by substitution and by elimination, with and without technology.   | <b>Student Edition:</b><br>Course 1: 197-200, 203-205, 208<br>Course 2: 49-67, 70-72, 139-144, 146, 149                             |
| 10. Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula and with technology.   | <b>Student Edition:</b><br>Course 1: 510-525<br>CPMP-Tools Algebra software<br>Course 2: 340-344, 348<br>Course 3: 112-114, 118-120 |

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| 11. Add, subtract, multiply and divide monomials and polynomials (division of polynomials by monomials only).                                      | <b>Student Edition:</b><br>Course 1: 215-229, 332-334, 343-344, 490, 508, 585<br>Course 2: 336-338, 340, 348<br>Course 3: 327-335, 337-345                                |
| 12. Simplify rational expressions by eliminating common factors and applying properties of integer exponents.                                      | <b>Student Edition:</b><br>Course 1: 304-306, 311-312, 332-334, 335-337, 343-344, 348, 358-359, 423 #32, 585<br>Course 3: 372-379, 380-388                                |
| <b>Analyze Change</b>  |   |
| 13. Model and solve problems involving direct and inverse variation using proportional reasoning.  | <b>Student Edition:</b><br>Course 1: Student Study Guide 25-32<br>Course 2: 25-29, 34-37  |
| 14. Describe the relationship between slope and the graph of a direct variation and inverse variation.   | <b>Student Edition:</b><br>Course 2: Opportunity to address 30-33, 42 #20   |
| 15. Describe how a change in the value of a constant in a linear or quadratic equation affects the related graphs.                                 | <b>Student Edition:</b><br>Course 1: 158 #1, 178 #24, #25, 469-472, 473-479, 482, 485 #18, 488 #25<br>CPMP-Tools CAS Parameter slider<br>Course 2: 232, 333, 335, 352 #28 |
| <b>Data Analysis and Probability Standard</b>  |   |
| <b>Data Collection</b>   |   |
| 1. Classify data as univariate (single variable) or bivariate (two variables) and as quantitative (measurement) or qualitative (categorical) data. | <b>Student Edition:</b><br>Course 1: Opportunity to address: Units 1, 2, 3, 5, 7, 8 (p137 #19)  |
| 2. Create a scatterplot for a set of bivariate data, sketch the line of best fit, and interpret the slope of the line of best fit.                 | <b>Student Edition:</b><br>Course 1: 150-184<br>Course 2: 280-290, 298, 305-310, 322-324<br>CPMP-Tools Statistics software  |
| <b>Statistical Methods</b>   |   |
| 3. Analyze and interpret frequency distributions based on spread, symmetry, skewness, clusters and outliers.                                       | <b>Student Edition:</b><br>Course 1: 74-142   |
| 4. Describe and compare various types of studies (survey, observation, experiment), and identify possible misuses of statistical data.             | <b>Student Edition:</b><br>Course 1: 98 #20 p99 #21<br>Course 2: 299-304, 310-313<br>Course 3: 89-91, 95  |

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| <p>5. Describe characteristics and limitations of sampling methods, and analyze the effects of random versus biased sampling; e.g., determine and justify whether the sample is likely to be representative of the population.</p>              | <p><b>Student Edition:</b><br/> Course 3: 74-80, 89-91, 92 #1-2, 95 #5-6, 97 #10-11, 98 #14-15, 104 #4, 256 #21, 257 #23, 262-263 #5 &amp; #6, 270 STM, 279 #17-18, 280 #20, 283-302, 313 #24, b., and Course 4</p> |
| <p>6. Make inferences about relationships in bivariate data, and recognize the difference between evidence of relationship (correlation) and causation.</p>   | <p><b>Student Edition:</b><br/> Course 2: 299-304, 310-313</p>  |
| <p><i>Probability</i></p>   |   |
| <p>7. Use counting techniques and the Fundamental Counting principle to determine the total number of possible outcomes for mathematical situations.</p>  | <p><b>Student Edition:</b><br/> Course 1: 291, 509 #30, 581 #22, and 584 #29<br/> Course 2: 539 #9</p>  |
| <p>8. Describe, create and analyze a sample space and use it to calculate probability.</p>  | <p><b>Student Edition:</b><br/> Course 1: 533-536, 542-543, 545 #10, 547 #18, 553 #1, 586<br/> Course 2: 522-525</p>  |
| <p>9. Identify situations involving independent and dependent events, and explain differences between, and common misconceptions about, probabilities associated with those events.</p>   | <p><b>Student Edition:</b><br/> Course 2: 522, 535, 536-542</p>   |
| <p>10. Use theoretical and experimental probability, including simulations or random numbers, to estimate probabilities and to solve problems dealing with uncertainty; e.g., compound events, independent events, simple dependent events.</p> | <p><b>Student Edition:</b><br/> Course 1: 551-583, 587-589<br/> CPMP-Tools Statistics Simulation software<br/> See also:<br/> Course 2: 522-535, 536-542, 545-558<br/> Course 3: 74-88, 92-97</p>                   |

| STANDARDS  |  | PAGE REFERENCES |
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| <b>Grade Ten</b>   |  |                 |
| <b>Number, Number Sense and Operations Standard</b>  |  |                 |
| <i>Number and Number Systems</i>   |  |                 |
| 1. Connect physical, verbal and symbolic representations of irrational numbers; e.g., construct $\sqrt{2}$ as a hypotenuse or on a number line.  | <b>Student Edition:</b><br>Course 2: 13, 40 #17, 41 #18, 48 #36, 343, 356, 478, 479, 585 #30<br><br><b>Previously addressed:</b> Course 1: 347 #25, 351 #36, 392 #20, #21, 446 #24, 451 #21, 454 #35 |                 |
| <i>Meaning of Operations</i>   |  |                 |
| 2. Explain the meaning of the $n$ th root.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 1: 335, 351 #35   |                 |
| <i>Computation and Estimation</i>  |  |                 |
| 3. Use factorial notation and computations to represent and solve problem situations involving arrangements.   | <b>Student Edition:</b><br>Opportunity to address: Course 2, Unit 8 Lesson 1   |                 |
| 4. Approximate the $n$ th root of a given number greater than zero between consecutive integers when $n$ is an integer; e.g., the 4th root of 50 is between 2 and 3.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 1: 335, 351#35  |                 |
| <b>Measurement Standard</b>  |  |                 |
| <i>Use Measurement Techniques and Tools</i>  |  |                 |
| 1. Explain how a small error in measurement may lead to a large error in calculated results.   | <b>Student Edition:</b><br>Course 2: Opportunity to address 467-476  |                 |
| 2. Calculate relative error.   | <b>Not addressed</b>   |                 |
| 3. Explain the difference between absolute error and relative error in measurement.  | <b>Not addressed</b>   |                 |
| 4. Give examples of how the same absolute error can be problematic in one situation but not in another; e.g., compare “accurate to the nearest foot” when measuring the height of a person versus when measuring the height of a mountain. | <b>Student Edition:</b><br>Opportunity to address: Course 2: 467-476<br><b>Previously addressed:</b> Course 1: 555-556, #6d, 573, #3f, and 578-579 #17   |                 |
| 5. Determine the measures of central and inscribed angles and their associated major and minor arcs.   | <b>Student Edition:</b><br>Opportunity to address: Course 2: 477-479<br>Course 3: 396-407, 408-417, 454-455  |                 |

## Geometry and Spatial Sense Standard

### *Characteristics and Properties*

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| 1. Formally define and explain key aspects of geometric figures, including:<br>a. interior and exterior angles of polygons;<br>b. segments related to triangles (median, altitude, midsegment);<br>c. points of concurrency related to triangles (centroid, incenter, orthocenter, circumcenter);<br>d. circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).   | <b>Student Edition:</b><br>Course 2: 184 #9<br>CPMP-Tools Geometry software<br>Course 3: 42 #7, 46 #15, 47 #21, 196-203, 204-208, 215-225, 396-407, 408-419, 454-455<br><b>Previously addressed:</b> Course 1: 46, 51, 62, 95 #13, 175, 205, 306, 315, 365, 389, 428, 550 #28, 590, 597 |
| 2. Recognize and explain the necessity for certain terms to remain undefined, such as point, line and plane.  | <b>Student Edition:</b><br>Course 2: Opportunity to address Unit 3<br>Course 3: Opportunity to address Unit 3 p. 31   |
| 3. Make, test and establish the validity of conjectures about geometric properties and relationships using counterexample, inductive and deductive reasoning, and paragraph or two-column proof, including:<br>a. prove the Pythagorean Theorem;<br>b. prove theorems involving triangle similarity and congruence;<br>c. prove theorems involving properties of lines, angles, triangles and quadrilaterals;<br>d. test a conjecture using basic constructions made with a compass and straightedge or technology. | <b>Student Edition:</b><br>Course 2: 162-180, 489-491, 510 #22&#23, 512 #25<br>CPMP-Tools Geometry software<br>Course 3: 28-39, 40-51, 162-178, 179-194, 195-214, 215-228, 229-233, 402, 416<br><b>Previously addressed:</b> Course 1: 257, 369-373, 374-377, 378-382, 383-395          |

### *Spatial Relationships*

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| 4. Construct right triangles, equilateral triangles, parallelograms, trapezoids, rectangles, rhombuses, squares and kites, using compass and straightedge or dynamic geometry software. | <b>Student Edition:</b><br>Course 2: 162-169, 171, 176, 178 #7, 253, 354 #36<br>CPMP-Tools Geometry software<br><b>Previously addressed:</b> Course 1: 367, 381, 420        |
| 5. Construct congruent figures and similar figures using tools, such as compass, straightedge, and protractor or dynamic geometry software.   | <b>Student Edition:</b><br>CPMP-Tools Geometry software<br>Course 2: 163-166, 177, 205-216, 233-250, 252<br>Course 3: 28, 190<br><b>Previously addressed:</b> Course 1: 386 |

### *Transformations and Symmetry*

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| 6. Identify the reflection and rotation symmetries of two- and three-dimensional figures. | <b>Student Edition:</b><br>Course 2: 101 #26, 193 #34<br><b>Previously addressed:</b> Course 1: 399-403, 407-411, 413-422, 454 |
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| 7. Perform reflections and rotations using compass and straightedge constructions and dynamic geometry software.   | <b>Student Edition:</b><br>Course 2: 195-229, 231-250, 252-256<br>CPMP-Tools Geometry Software  |
| 8. Derive coordinate rules for translations, reflections and rotations of geometric figures in the coordinate plane.   | <b>Student Edition:</b><br>Course 2: 195-216, 220-222, 225 #21  |
| 9. Show and describe the results of combinations of translations, reflections and rotations (compositions); e.g., perform compositions and specify the result of a composition as the outcome of a single motion, when applicable. | <b>Student Edition:</b><br>Course 2: 210-216, 222-227, 231-250, 254-256<br>Course 3: 208-213  |
| <b>Visualization and Geometric Models</b>  |   |
| 10. Solve problems involving chords, radii and arcs within the same circle.  | <b>Student Edition:</b><br>Course 2: 178, 356 #42<br>Course 3: 396-407, 408-417, 454-455  |
| <b>Patterns, Functions and Algebra Standard</b>  |   |
| <b>Use Patterns, Relations and Functions</b>   |   |
| 1. Define function formally and with $f(x)$ notation.  | <b>Student Edition:</b><br>Course 2: 326-331, 345-348, 349 #17, 583 #24   |
| 2. Describe and compare characteristics of the following families of functions: square root, cubic, absolute value and basic trigonometric functions; e.g., general shape, possible number of roots, domain and range.             | <b>Student Edition:</b><br>Course 2: 10-15, 17 #4, 18-23, 459-466, 478 #9 & #10, 520<br>Course 3: 100, 116, 117, 120, 418, 432-437, 439-449, 599 (and Course 4)<br><b>Previously addressed:</b> Course 1: 346 #24, 487 #23, 522 #23 |
| <b>Use Algebraic Representations</b>   |   |
| 3. Solve equations and formulas for a specified variable; e.g., express the base of a triangle in terms of the area and height.  | <b>Student Edition:</b><br>Course 2: 25-46, 69-72, 68 #27, 229 #38, 391 #29   |
| 4. Use algebraic representations and functions to describe and generalize geometric properties and relationships.  | <b>Student Edition:</b><br>Course 2: 6 # 5e, 7 #7, 11-12, 16 #1h, 18 #5&#6, 39 #13&#14, 40-41, 93 #9, 113-118, 124 #11, 125 #14, 163-192, 194 #41, 196-229, 458-484   |
| 5. Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.   | <b>Student Edition:</b><br>Course 2: 342-344, 374 #23, 375 #24, 485 #32<br>Course 3: 112-117, 118-124<br><b>Previously addressed:</b> Course 1: 510-523, 528  |
| 6. Solve equations and inequalities having rational expressions as coefficients and solutions.   | <b>Student Edition:</b><br>Course 2: 112-117, 118-124, 193 #37, 340-344, 348 #13&#14, 353 #32, 357 #47, 360-375, 385 #20, 391 #29   |

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| 7. Solve systems of linear inequalities.  | <b>Student Edition:</b><br>Course 2: 49-68, 70-72, 130 #27, 132-156, 159-160, 514 #29, 584 #26<br>Course 3: 127-143, 144-155  |
| 8. Graph the quadratic relationship that defines circles.   | <b>Student Edition:</b><br>Course 2: 175-180, 184 #11, 187 #17, 356 #42   |
| 9. Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.  | <b>Student Edition:</b><br>Course 2: 170-175, 183 #7&#8, 184 #9&#10, 187 #16, 189 #25, 191 #29, 193 #36, 251 #23  |
| 10. Solve real-world problems that can be modeled using linear, quadratic, exponential or square root functions.  | <b>Student Edition:</b><br>Course 2: Units 1 and 5<br><b>Previously addressed:</b> Course 1: Throughout see: Units 1, 3, 5, 7   |
| 11. Solve real-world problems that can be modeled, using systems of linear equations and inequalities.  | <b>Student Edition:</b><br>Course 2: 49-67, 69-72, 139-151, 357 #47<br>Course 3: 128-143, 144-155, 159-160  |
| <b>Analyze Change</b>   |   |
| 12. Describe the relationship between slope of a line through the origin and the tangent function of the angle created by the line and the positive x-axis.   | <b>Student Edition:</b><br>Course 2: 478 #10, 480 #16, 482 #26<br>CPMP-Tools Geometry software  |
| <b>Data Analysis and Probability Standard</b>   |   |
| <b>Data Collection</b>  |   |
| 1. Describe measures of center and the range verbally, graphically and algebraically.   | <b>Student Edition:</b><br>Course 2: 155 #26, 230 #43, 278 #18<br><b>Previously addressed:</b> Course 1: 90-101, 144-147  |
| 2. Represent and analyze bivariate data using appropriate graphical displays (scatterplots, parallel box-and-whisker plots, histograms with more than one set of data, tables, charts, spreadsheets) with and without technology. | <b>Student Edition:</b><br>Course 2: 48 #34, 258-276, 280-319, 322-324<br>CPMP-Tools Statistics software<br><b>Previously addressed:</b> Course 1: 74-102, 103-142, 144-147 |
| 3. Display bivariate data where at least one variable is categorical.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 1: 75 TATS, 76 #1, 78 #3, 80 #7, 91 #4, 93 #8, 110 #4, 112 CYU, 115 # 5bii, 135 #12,                         |
| 4. Identify outliers on a data display; e.g., use interquartile range to identify outliers on a box-and-whisker plot.   | <b>Student Edition:</b><br>Course 2: 77 #4c, 155 #26, 265-268, 272 #4, 278 #18<br><b>Previously addressed:</b> Course 1: 108-123, 127, 128, 129-142, 144-147                |

| <i>Statistical Methods</i>   |  |
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| 5. Provide examples and explain how a statistic may or may not be an attribute of the entire population; e.g., intentional or unintentional bias may be present.                                       | <b>Student Edition:</b><br>Opportunity to address in Course 2: 299-304, 312, 313<br>Course 4: Unit 9 Lesson 2  |
| 6. Interpret the relationship between two variables using multiple graphical displays and statistical measures; e.g., scatterplots, parallel box-and-whisker plots, and measures of center and spread. | <b>Student Edition:</b><br>Course 2: 258-276, 278 #18, 280-319, 322-324<br><b>Previously addressed:</b> Course 1: 74-78, 91 #4, 93 #8, 95 #12, 98 #20, 106 #6, 110 #4, 111 #6, 115 #5, 131 #5, 132 #6, 133 #9, 135 #12, 137, 138 |
| <i>Probability</i>   |  |
| 7. Model problems dealing with uncertainty with area models (geometric probability).   | <b>Student Edition:</b><br>Course 2: 524-526, 540 #12&#13, 554 #8, 582 #22<br><b>Previously addressed:</b> Course 1: 568-570, 578 #13 & 14, 583 #24, 588 #5  |
| 8. Differentiate and explain the relationship between the probability of an event and the odds of an event, and compute one given the other.   | <b>Student Edition:</b><br>Course 2: Opportunity to address: 522-528, 545-580<br>Course 3: 278   |

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| <b>Grade Eleven</b>   |   |                 |
| <b>Number, Number Sense and Operations Standard</b>   |   |                 |
| <i>Number and Number Systems</i>  |   |                 |
| 1. Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative. | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 2: 132-138, 148 #8, 150 #12  |                 |
| 2. Determine what properties hold for vector addition and multiplication, and for scalar multiplication.  | <b>Student Edition:</b><br>Course 4: Unit 2   |                 |
| 3. Represent complex numbers on the complex plane.  | <b>Student Edition:</b><br>Course 3: 360 #14<br>Course 4: Unit 3  |                 |
| <i>Meaning of Operations</i>  |   |                 |
| 4. Use matrices to represent given information in a problem situation.  | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 2: 74-100, 103-129, 157-160, 231-250, 252-256, 295   |                 |
| 5. Model, using the coordinate plane, vector addition and scalar multiplication.  | <b>Student Edition:</b><br>Course 4: Unit 2   |                 |
| <i>Computation and Estimation</i>   |   |                 |
| 6. Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases.                          | <b>Student Edition:</b><br>CPMP-Tools Algebra software<br><b>Previously addressed:</b> Course 2: 82-100, 103-127, 133-153, 154 #20, 229 #37, 351 #21, 356 #44, 514 #30  |                 |
| 7. Compute sums, differences, products and quotients of complex numbers.  | <b>Student Edition:</b><br>Course 4: Unit 3   |                 |
| 8. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations;<br>e.g., $27^{2/3} = (27^{1/3})^2 = 9$ .                | <b>Student Edition:</b><br>Course 3: Unit 5 Review 51 #31, 72 #32, 557 #30<br><b>Previously addressed:</b> Course 1: 335-337, 351, 358-359<br>Course 2: 24 #22&#25, 559 #21, Unit 2 Unit Resource Master URM 54 |                 |

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| 9. Use vector addition and scalar multiplication to solve problems.  | <b>Student Edition:</b><br>Course 4: Unit 2  |
| <b>Measurement Standard</b>  |  |
| <i>Measurement Units</i>   |  |
| 1. Determine the number of significant digits in a measurement.  | <b>Student Edition:</b><br>Course 3: Opportunity to address: 237<br><b>Previously addressed:</b> Course 2: 467-473   |
| 2. Use radian and degree angle measures to solve problems and perform conversions as needed.   | <b>Student Edition:</b><br>Course 3: 425-437, 438-449, 455-456<br><b>Previously addressed:</b> Course 2: 467-473, 474-482  |
| <i>Use Measurement Techniques and Tools</i>  |  |
| 3. Derive a formula for the surface area of a cone as a function of its slant height and the circumference of its base.                      | <b>Student Edition:</b><br>Opportunity to address Course 1: 448 #13  |
| 4. Calculate distances, areas, surface areas and volumes of composite three-dimensional objects to a specified number of significant digits. | <b>Student Edition:</b><br>Course 3: Review 50 #27<br><b>Previously addressed:</b> Course 1: 447 #12, 448, #13, #14, 451 #24, 458 #  |
| 5. Solve real-world problems involving area, surface area, volume and density to a specified degree of precision.                            | <b>Student Edition:</b><br>Course 3: Review 7-8, 26 #25, 50 #27, 156 #36, 257 #25, 281 #26, 314 #31, 380 #1, 383 #12, 418 #32<br><b>Previously addressed:</b> Course 1: 25, 62, 64, 70, 205, 320, 321, 394, 415, 423, 447, 448, 452, 453, 506-507<br>Course 2: 506 #9 and review tasks |
| <b>Geometry and Spatial Sense Standard</b>   |  |
| <i>Spatial Relationships</i>   |  |
| 1. Use polar coordinates to specify locations on a plane.  | <b>Student Edition:</b><br>Course 4: Unit 2, Unit 8  |
| <i>Transformations and Symmetry</i>  |  |
| 2. Represent translations using vectors.   | <b>Student Edition:</b><br>Course 4: Unit 2  |
| 3. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations.                          | <b>Student Edition:</b><br>Course 4: Unit 2  |

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| <p>4. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines.</p>   | <p><b>Student Edition:</b><br/>Course 3: 125 #30, 168-169, 171-172, 593 #15, 594 #18<br/><b>Previously addressed:</b> Course 2: 488-497, 503-513</p>  |
| <p><i>Visualization and Geometric Models</i></p>  |   |
| <p>5. Identify, sketch and classify the cross sections of three-dimensional objects.</p>  | <p><b>Student Edition:</b><br/>Course 4: Unit 6<br/><b>Previously addressed:</b> Course 1: 435-436, 438, 445, 446, 453, 484</p>   |
| <p><b>Patterns, Functions and Algebra Standard</b></p>  |   |
| <p><i>Use Patterns, Relations and Functions</i></p>   |   |
| <p>1. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest.</p>   | <p><b>Student Edition:</b><br/>Course 3: 458-467, 478-479, 481-489, 499-501<br/><b>Previously addressed:</b> Course 1: 292-301, 307-319, 323-332, 338-351</p>   |
| <p>2. Translate a recursive function into a closed form expression or formula for the <math>n</math>th term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years.</p>  | <p><b>Student Edition:</b><br/>Course 3: 481-489, 499-501, 553-536</p>  |
| <p>3. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior.</p> | <p><b>Student Edition:</b><br/>Course 3: 28 #33, 282 #28, 320-335, 336-345, 353-356, 357-360, 390-394, 432-437, 439-449, 577-590, 595 #21<br/>Course 4: Unit 1</p>  |
| <p>4. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology.</p>  | <p><b>Student Edition:</b><br/>Course 3: 28 #33, 282 #28, 320-335, 336-345, 353-356, 357-360, 390-394, 432-437, 439-449, 577-590, 595 #21<br/>CPMP-Tools Algebra software<br/>Course 4: Unit 1<br/><b>Previously addressed:</b> Course 1: 510-523</p> |
| <p>5. Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the <math>y</math>-axis, <math>x</math>-axis or <math>y = x</math>.</p>   | <p><b>Student Edition:</b><br/>Course 3: 597 #29<br/>Course 4: Unit 1<br/><b>Previously addressed:</b> Course 1: 478<br/>Course 2: 21</p>   |
| <p><i>Use Algebraic Representations</i></p>   |   |
| <p>6. Represent the inverse of a function symbolically and graphically as a reflection about <math>y = x</math>.</p>  | <p><b>Student Edition:</b><br/>Course 3: 547 #8, 552 #14, 573 #25, 579-580, 595 #24</p>   |

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| 7. Model and solve problems with matrices and vectors.   | <b>Student Edition:</b><br>Course 4: Unit 2<br><b>Previously addressed:</b> Course 2: 74-160   |
| 8. Solve equations involving radical expressions and complex roots.  | <b>Student Edition:</b><br>Course 3: 354-356, 358<br>Course 4: Unit 3  |
| 9. Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution).   | <b>Student Edition:</b><br>Course 3: 495-498, 506 #19<br>Course 4: Unit 3 and 6<br><b>Previously addressed:</b> Course 2: 152 #17<br>CPMP-Tools Algebra software   |
| 10. Describe the characteristics of the graphs of conic sections.  | <b>Student Edition:</b><br>Course 4: Unit 3 and 6  |
| <b>Analyze Change</b>  |  |
| 11. Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation.   | <b>Student Edition:</b><br>Course 3: Opportunity to address: 28 #33, 125 #28, 552 #14, 564, 573 #25 & #26<br>Course 4: Unit 1, Unit 3, and Unit 4<br><b>Previously addressed:</b> Course 1: 291-303, 322-331, 345 #20 & #21, 351 #34 |
| <b>Data Analysis and Probability Standard</b>  |  |
| <b>Data Collection</b>   |  |
| 1. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation. | <b>Student Edition:</b><br>Course 3: 74-88, 92-94<br>CPMP-Tools Statistics software<br>Course 4: Unit 9 L2<br><b>Previously addressed:</b> Course 2: U4 Projects   |
| 2. Describe the role of randomization in a well-designed study, especially as compared to a convenience sample, and the generalization of results from each.   | <b>Student Edition:</b><br>Course 3: 74-91, 92-99<br>CPMP-Tools Custom Tool: Randomization Distributions<br>Course 4: Unit 9 L2<br><b>Previously addressed:</b> Course 2: Unit 4 Assessments, Projects                               |
| <b>Statistical Methods</b>   |  |
| 3. Describe how a linear transformation of univariate data affects range, mean, mode and median.   | <b>Student Edition:</b><br>Course 3: 242-244<br><b>Previously addressed:</b> Course 1: 124-128, 134, 136 #15, 139 #21<br>Course 2: Review tasks  |

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| <p>4. Create a scatterplot of bivariate data, identify trends, and find a function to model the data.</p>   | <p><b>Student Edition:</b><br/> Course 3: Review 51 #34<br/> <b>Previously addressed:</b> Course 1: 156, 161-167, 169, 170-174, 178, 181-183, 206-207, 302, 310, 311, 467<br/> CPMP-Tools Statistics software<br/> Course 2: 3-5, 8 #11, 13-14, 19 #8, 20 #10, 21 #12, 23 #19, 100 #23, 280-290, 305-310</p>  |
| <p>5. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation.</p> | <p><b>Student Edition:</b><br/> Course 3: Review tasks 126 #32<br/> CPMP-Tools Statistics software<br/> <b>Previously addressed:</b> Course 2: 280-320, 322-324, 357 #46, 551 #5</p>  |
| <p>6. Use technology to compute the standard deviation for a set of data, and interpret standard deviation in relation to the context or problem situation.</p>   | <p><b>Student Edition:</b><br/> Course 3: 236-247, 248-257, 259-270, 271-278, 283-302, 303-313, 316-318<br/> CPMP-Tools Statistics Custom Tools:<br/> Estimation Center and Estimate Center and Spread<br/> <b>Previously addressed:</b> Course 1: 116-123, 124-128, 129-134, 136, 139, 141, 144-147, 250 #22, 279 #22<br/> Course 2: 250 #22, 279#22</p> |
| <p>7. Describe the standard normal curve and its general properties, and answer questions dealing with data assumed to be normal.</p>   | <p><b>Student Edition:</b><br/> Course 3: 236-247, 248-257, 283-302, 303-313, 316-318<br/> CPMP-Tools Statistics software<br/> <b>Previously addressed:</b> Course 1: 116-118, 120, 139 #22, 141 #27</p>  |
| <p>8. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions.</p>  | <p><b>Student Edition:</b><br/> Course 3: 74-91, 92-99, 236-247, 248-257, 259-270, 271-278, 283-302, 303-313, 316-318<br/> CPMP-Tools Statistics software<br/> <b>Previously addressed:</b> Examples Throughout in Course 1: 18, 44, 98, 137, 139 #25, 172 #11, 348 #31<br/> Course 2: 258-324</p>  |
| <p>9. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques.</p>   | <p><b>Student Edition:</b><br/> Course 3: 74-91, 92-99<br/> Course 4: Unit 9</p>  |

*Probability*

10. Understand and use the concept of random variable, and compute and interpret the expected value for a random variable in simple cases.

**Student Edition:**

Course 3: 260 #2

**Previously addressed:** Course 1: 532-548, 552-564, 571-583, 586-589

Course 2: 545-558, 570-580

11. Examine statements and decisions involving risk; e.g., insurance rates and medical decisions.

**Student Edition:**

Course 3: 269 #7

**Previously addressed:** Course 2: 542 #19, 547 #4, p548, STMC, 556 #14, 587 #1

| STANDARDS   | PAGE REFERENCES  |
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| <b>Grade Twelve</b>   |  |
| <b>Number, Number Sense and Operations Standard</b>   |  |
| <i>Number and Number Systems</i>  |  |
| 1. Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers.  | <b>Student Edition:</b><br>Course 4: Unit 3  |
| <i>Computation and Estimation</i>   |  |
| 2. Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations.   | <b>Student Edition:</b><br>Course 4: Unit 9  |
| <b>Measurement Standard</b>   |  |
| <i>Use Measurement Techniques and Tools</i>   |  |
| 1. Solve problems involving derived measurements; e.g., acceleration and pressure.  | <b>Student Edition:</b><br>Course 4: Unit 7  |
| 2. Use radian measures in the solution of problems involving angular velocity and acceleration.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 3: 427-432                                |
| 3. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations. | <b>Student Edition:</b><br>Course 4: Unit 7  |
| <b>Geometry and Spatial Sense Standard</b>  |  |
| <i>Transformations and Symmetry</i>   |  |
| 1. Use matrices to represent translations, reflections, rotations, dilations and their compositions.  | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 2: 231-250<br>CPMP-Tools Algebra software |
| 2. Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction and double angle.   | <b>Student Edition:</b><br>Course 4: Unit 4  |

| <i>Visualization and Geometric Models</i>  |  |
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| 3. Relate graphical and algebraic representations of lines, simple curves and conic sections.  | <b>Student Edition:</b><br>Course 4: Units 1, 3, 4, 5, 6   |
| 4. Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical and hyperbolic.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 2: Unit 3 Project<br>Course 3: 48   |
| <b>Patterns, Functions and Algebra Standard</b>  |  |
| <i>Use Patterns, Relations and Functions</i>   |  |
| 1. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 3: 458-467, 468-480, 481-498, 499-512   |
| 2. Translate between the numeric and symbolic form of a sequence or series.  | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 3: 458-467, 468-480, 481-498, 499-512   |
| 3. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior. | <b>Student Edition:</b><br>Course 4: Units 1, 3, 4<br><b>Previously addressed:</b> Course 3: 125 #28, 559-567, 570 #17, 573 #25, 26, 28, 29, 578-589, 590-599, 602-604 |
| 4. Represent the inverse of a transcendental function symbolically.  | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 3: 559-567, 570 #17, 578-589, 590-599, 604 STM part c   |
| <i>Use Algebraic Representations</i>   |  |
| 5. Set up and solve systems of equations using matrices and graphs, with and without technology.   | <b>Student Edition:</b><br><b>Previously addressed:</b> Course 2: 50-67, 133-155<br>Course 3: 127-155  |
| 6. Make arguments about mathematical properties using mathematical induction.  | <b>Student Edition:</b><br>Course 4: Unit 8  |
| 7. Make mathematical arguments using the concepts of limit.  | <b>Student Edition:</b><br>Course 4: Unit 7  |
| 8. Compare estimates of the area under a curve over a bounded interval by partitioning the region with rectangles; e.g., make successive estimates using progressively smaller rectangles.             | <b>Student Edition:</b><br>Course 4: Unit 7  |
| 9. Translate freely between polar and Cartesian coordinate systems.  | <b>Student Edition:</b><br>Course 4: Unit 2 and 4  |

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| <i>Analyze Change</i>   |   |
| 10. Use the concept of limit to find instantaneous rate of change for a point on a graph as the slope of a tangent at a point.  | <b>Student Edition:</b><br>Course 4: Unit 7   |
| <b>Data Analysis and Probability Standard</b>   |   |
| <i>Data Collection</i>  |   |
| 1. Identify and use various sampling methods (voluntary response, convenience sample, random sample, stratified random sample, census) in a study.  | <b>Student Edition:</b><br>Course 4: Unit 9   |
| <i>Statistical Methods</i>  |   |
| 2. Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function.  | <b>Student Edition:</b><br>Course 4: Unit 5   |
| 3. Describe the shape and find all summary statistics for a set of univariate data, and describe how a linear transformation affects shape, center and spread.  | <b>Student Edition:</b><br><b>Previously addressed:</b><br>Course 1: 124-128, 134, 136, 137, 139 #21<br>CPMP-Tools Statistics software<br>Course 2: 278 #18   |
| 4. Apply the concept of a random variable to generate and interpret probability distributions, including binomial, normal and uniform.  | <b>Student Edition:</b><br>Course 4: Unit 9<br>CPMP-Tools Statistics software<br><b>Previously addressed:</b><br>Course 1: 532-548, 552-564, 571-583, 586-589<br>Course 2: 545-551, 552-558<br>Course 3: 236-247, 248-258, 260-270, 271-280 |
| 5. Use sampling distributions as the basis for informal inference.  | <b>Student Edition:</b><br>Course 4: Unit 9 L1, L13<br><b>Previously addressed:</b><br>Course 2: 574 #3, 575 #6<br>Course 3: 74-91, 92-100, 260-270, 271-280  |
| <i>Probability</i>  |   |
| 6. Use theoretical or experimental probability, including simulations, to determine probabilities in real-world problem situations involving uncertainty, such as mutually exclusive events, complementary events, and conditional probability. | <b>Student Edition:</b><br>Course 4: Unit 9 L1<br>CPMP-Tools Statistics Simulation software<br><b>Previously addressed:</b> Course 1: 536-548, 548-583<br>Course 2: 522-588<br>Course 3: 259-280  |